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Amendments to the Claims

1.   (CURRENTLY AMENDED) A positioning method using a transmitter device (2) having a radio frequency transmitter (12) and a receiver device (4) having a receiver (22), a first one of which is a reference device at a known position and the other of which is a test device at an unknown position, using a number of reflectors at known positions, the method comprising

transmitting a signal from the transmitter (2) to the receiver (4), the signal having a number of signal components travelling from the transmitter (2) to the receiver (4) via the reflectors or directly;

receiving a plurality of the signal components of the transmitted signal in the receiver (4);

measuring the arrival times of the signal components;

identifying the signal components with the reflectors off which the signal component has reflected; and

calculating the unknown position by fitting the measured arrival times of the signal components to the known positions of the identified reflectors and the position of the reference device.

2.   (ORIGINAL) A positioning method according to claim 1 including testing a plurality of possible permutations of assignments of the signal components to the reflectors and identifying the permutation of assignments of the signal components to the reflectors off which the signal component has reflected that gives a best fit of calculated arrival times to the measured arrival times of the signal components and/or that allows a solution of the unknown position and/or that gives the best fit of calculated unknown position to likely unknown position.

3.   (ORIGINAL) A positioning method according to claim 2 wherein each possible permutation of identifications of the signal components with the reflectors is tested in turn.

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4.   (ORIGINAL) A positioning method according to claim 2 further including selecting a subset of the possible permutations and testing the permutations of the selected subset in turn.

5.   (CURRENTLY AMENDED) A positioning method according to claim 4 including measuring in the receiver (4) the angle of arrival of the signal components, and selecting the subset of permutations based on the angle of arrival information.

6.   (CURRENTLY AMENDED) A positioning method according to any preceding claim claim 1 further comprising measuring the signal strength of the received signal components, wherein the step of identifying the signal components with the reflectors includes fitting received signal strengths to expected values.

7.   (CURRENTLY AMENDED) A positioning method according to any preceding claims claim 1 wherein the signals are radio frequency signals.

8.   (ORIGINAL) A positioning method according to claim 7 including transmitting an ultra-wideband signal as the transmitted radio frequency signal.

9.   (CURRENTLY AMENDED) A positioning method according to any preceding claim claim 1 wherein the step of calculating the unknown position of the transmitter or receiver from the measured arrival times is carried out by solving the simultaneous equations

$$c\tau_0 = \sqrt{(x_T - x_R)^2 + (y_T - y_R)^2} + ct_c \qquad (1)$$

$$c\tau_i = \sqrt{(x_T - x_i)^2 + (y_T - y_i)^2} + \sqrt{(x_i - x_R)^2 + (y_i - y_R)^2} + ct_c \qquad (2).$$

for i = 1...n

where: τ_0 is the measured arrival time of the direct signal component;

τ_i (i = 1, 2, ...n) are the measured arrival times of the n indirect signal components;

(x_T, y_T) is the position of the transmitter;

(x_R, y_R) is the position of the receiver;

(x_i, y_i) $(i = 1, 2, \ldots n)$ are the positions of the reflectors identified with the ith signal component;

t_c is the unknown clock offset of the receiver clock relative to the transmitter clock; and

c is the speed of light.

10.   (CURRENTLY AMENDED) A positioning system for use in an environment having a plurality of reflectors (6) at known positions, comprising;

a transmitter (2) for transmitting a signal;

a receiver (4) for receiving a plurality of signal components of the transmitted signal, each signal component being received either directly from the transmitter or indirectly off a reflector (6), the receiver (4) being arranged to measure the arrival times of the signal components; and

a location server comprising means (39) for storing the known position of one of the transmitter (2) and receiver (4) and for storing the known position of a plurality of reflectors (6), and means (36) for identifying a plurality of received signal components with respect to the reflectors (6) off which the respective signal components were reflected and calculating the unknown position of the other of the transmitter (2) and receiver (4) by fitting the measured arrival times of the received signal components to the stored known positions.

11.   (CURRENTLY AMENDED) A location server for calculating the unknown position of one of a transmitter (2) or a receiver (4) from measured arrival times at the receiver (4) of a plurality of received signal components resulting from a signal transmitted by the transmitter (2), the location server comprising means (39) for storing the known position of one of the transmitter (2) and receiver (4) and for storing the known position of a plurality of reflectors (6), and means (36) for identifying a plurality of received signal components with respect to the reflectors (6) off which the respective signal components were reflected and calculating the unknown position of the other of the transmitter (2) and receiver (4) by fitting measured arrival times of the received signal components to the stored known positions.

12.   (CURRENTLY AMENDED) A location server as claimed in claim 11, further comprising the transmitter ~~(2)~~.

13.   (CURRENTLY AMENDED) A location server as claimed in claim 11, further comprising the receiver ~~(4)~~.

14.   (CURRENTLY AMENDED) A location server as claimed in ~~any of claims 11, 12, or 13,~~ claim 11 implemented in an integrated circuit.